

A SURVEY OF FOODSTUFFS FORTIFIED WITH VITAMINS AVAILABLE ON THE MARKET IN WARSAW

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ABSTRACT

Background. Foodstuffs fortified with vitamins and/or minerals are nowadays continually being developed, leading to an increasing diversity of these products being available on the market. This contributes to increased consumption of added nutrients, which can be an effective tool for improving public health.

Objectives. To identify and characterise products fortified with vitamins, available on the Warsaw foodstuff market, which can thereby be used as a source of information for the assessment of dietary micronutrient intake.

Material and methods. Data were gathered using the information provided on labels from foodstuff products found in 14 Warsaw supermarkets during March to October 2012.

Results. There were 588 products found to be fortified with vitamins. The number of vitamins added ranged from one in 193 products to twelve in 14 products. The group of vitamins used for enrichment consisted of: A, D, E, B₁, B₂, B₆, B₁₂, C, niacin, pantothenic acid, folic acid and biotin. Juices, non-alcoholic beverages (29.4%) and cereal products (18.9%) constituted the largest product groups. In addition, fortified vitamins were also significantly present in sweets (15.8%), instant beverages and desserts (13.6%), milk products, fat spreads and soy products. The most frequently added vitamins were: vitamin C (58% products), vitamin B₆ (46%) and B₁₂ (45%), whilst the least frequently added was biotin (16%). The highest content of vitamins A and D were seen in fat spreads, whereas the highest levels of B vitamins, vitamin C and E were observed in certain sweets.

Conclusions. The wide range of fortified products available can serve to increase vitamin intake in many population groups, especially in children and teenagers. In order that consumers can make informed choices in buying these product types, appropriate education is necessary to raise public awareness of the health issues involved.

Key words: *fortified food, vitamins, Warsaw foodstuffs market*

STRESZCZENIE

Wprowadzenie. Rozwój i urozmaicenie asortymentu na rynku produktów z dodatkiem witamin i/lub składników mineralnych przyczynia się do wzrostu spożycia dodanych składników, co może być skutecznym narzędziem poprawy zdrowia społeczeństwa.

Cel badań. Celem badań była identyfikacja i charakterystyka asortymentu produktów z dodatkiem witamin dostępnych na rynku warszawskim, wykorzystywana jako dodatkowa informacja przy ocenie pobrania witamin i składników mineralnych z racjami pokarmowymi.

Materiał i metody. Dane o produktach ogólnego przeznaczenia zaczerpnięto z informacji zawartych na opakowaniach, badanie przeprowadzono w 14 dużych sieciach handlowych w Warszawie, w okresie marzec - październik 2012 roku.

Wyniki. W sprzedaży dostępnych było 588 produktów z dodatkiem witamin. Do produktów dodawano od 1 (193 produkty) do 12 (14 produktów) witamin - witaminę A, D, E, B₁, B₂, B₆, B₁₂, C, niacynę, kwas pantotenowy, kwas foliowy, biotynę. Stwierdzono, iż najczęściej produktów wzbogaconych było w witaminę C (58%), a następnie w witaminę B₆ (46%) i B₁₂ (45%). Do najmniejszej liczby produktów dodawano biotynę - 16%. Najliczniejszą grupę stanowiły soki i napoje bezalkoholowe (29,4%) oraz produkty zbożowe (18,9%). Mniejszy udział w rynku miały wzbogacone w witaminy słodczyce (15,8%), a ponadto instant napoje i desery (13,6%). Witaminy dodawane były również do produktów mlecznych, tłuszczów do smarowania oraz produktów sojowych. Najwyższe zawartości witaminy A i D stwierdzono w tłuszczach do smarowania, w przypadku witamin z grupy B oraz witaminy C i E maksymalne ilości stwierdzono w cukierkach.

Wnioski. Szeroki asortyment produktów wzbogaconych umożliwia zwiększenie spożycia tych składników odżywczych w różnych grupach populacyjnych, szczególnie wśród dzieci i młodzieży. Aby konsument świadomie i właściwie dokonywał wyboru przy zakupie tego typu żywności, potrzebna jest odpowiednia edukacja żywieniowa.

Słowa kluczowe: *żywność wzbogacona, witaminy, warszawski rynek żywnościowy*

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INTRODUCTION

The intention of food fortification, irrespective of whether certain nutrient(s) are naturally present or not, is to combat any nutritional deficits in the population as a whole, or in vulnerable subgroups. Vitamins and minerals can also be added to compensate for losses occurred during food processing or for products considered substitutes (eg. margarines) to the nutritional value was similar [6]. Those population groups more susceptible to nutritional deficiencies are comprised of children, adolescents, pregnant or breast-feeding women, the elderly, persons needing special diets or those undergoing long-term drug treatment [16, 21].

Many countries have appropriate legislation for obligatory fortification of some foodstuffs with vitamins and/or minerals; for example cereals with folic acid, skimmed with vitamins A and D or drinking water with fluoride [20]. In Poland the addition of iodine to table salt is mandatory as is the enrichment of fat spreads with vitamin A and D, however this excludes milk fats [12].

Within the food industry, the practice of voluntarily adding nutrients to foodstuffs is widespread and is closely linked to being competitive, as well as in attempting to achieve market differentiation; a typical marketing tool [6]. The legislation within the EU governing the voluntary addition of vitamins, minerals and certain other substances is defined by Regulation (EC) 1925/2006 [8]. Its effectiveness is being assessed by EU Member States in accordance with the EC implementing regulation 489/2012. In MSs vital data is being gathered that includes: market development of foodstuffs fortified with vitamins and minerals together with consumption patterns and amounts of nutrients consumed with such products. The EC extended the deadline for receiving such data until 1st July 2013 [2].

The developing market and increasing diversity of fortified foodstuffs has inevitably led to increases in the consumption of vitamins and/or minerals by the popula-

tion at large, which has now led to this particular dietary source to be additionally included in subsequent intake assessments. Due to continual market fluctuations, it is impossible to include all fortified products in food composition. Thus in order to properly conduct assessment of nutrient intake, there is a need to constantly monitor the content of fortified foodstuffs on the market. The study aims were to identify and characterise foodstuffs fortified with vitamins that were present on the Warsaw market during 2012.

MATERIAL AND METHODS

The survey was conducted during March to October 2012 at major supermarkets in Warsaw. This included: Alma, Auchan, Biedronka, Bomi, Carrefour, E.Leclerc, Lewiatan, Lidl, Marcpol, Kaufland, Piotr and Paweł, Real, Tesco and Żabka. Relevant nutritional data were obtained from the product labels. Products that contained vitamins added for non-nutritional purposes (e.g. vitamin C as an antioxidant) were excluded. In addition, products intended for special nutritional purposes, such as food for infants or small children were also excluded because they are in fact covered by entirely separate legislation.

Products fortified with vitamins were classified into categories defined by the FoodEx classification system [14]. Summary statistics of the data were presented as means and standard deviation, ranges and medians of the amount of certain vitamins found in the defined product groups. Furthermore, the given amounts of vitamins described on the product labels were checked for compliance with the relevant regulations.

RESULTS AND DISCUSSION

It was found that there were 588 foodstuff products available on the market which were fortified with vita-

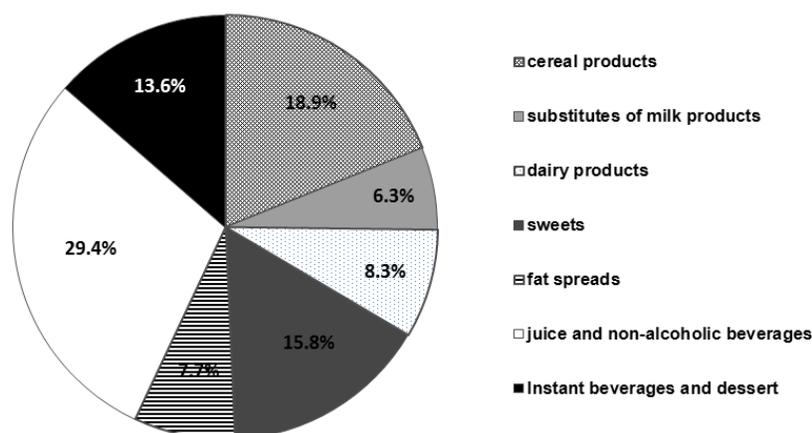


Figure 1. Food groups share in Warsaw market of food products fortified with vitamins in year of 2012

mins during 2012. The largest groups were fruit juices and non-alcoholic beverages at 29.4% and cereal products at 18.9%. A smaller market share was observed for sweets at 15.8% and instant beverages and desserts at 13.6% (Figure 1). Information provided on product labels were in accordance with the binding regulations. Manufacturers are allowed to voluntarily add 13 vitamins to foodstuff products, namely; vitamins A and D, vitamins E, K, B₁, B₂, niacin, pantothenic acid, vitamin B₆, folic acid, vitamin B₁₂, biotin and vitamin C [3]. The amounts of vitamins added per 100 g/100 ml product or if the portion size of the product is less than 100 g/100ml should contain between 15-50% of the nutrient reference values (NRVs) for nutrition labelling and which should be stated as being so on the label. In the case of vitamin C and folic acid, the content is allowed to vary between 15 to 100% NRVs because of losses occurred during food preparation. Manufacturers are legally obliged to provide the amounts of endogenous vitamins present in their products plus the amounts added [3, 8, 11, 12]. The presented study demonstrated that 2.7% of the products, (i.e. 16 items consisting of 5 cereals, 8 dairy and 3 soy-desserts), were labelled with amounts of vitamins C, E, B₆ and B₁₂ that fell below the current 15% NRVs value; these were however in compliance with previous regulations [10]. Such products were in fact legally allowed to be on the market until 31st October 2012 [11].

Vitamin content of fortified products available on the current market

The contents of defined vitamins according to fortified product groups that were available on the Warsaw market during 2012 are shown in Table 1. It was determined that the number of vitamins added to one foodstuff product ranged from one (in 193 products) to twelve (in 14 products). The group of vitamins used for enrichment consisted of: vitamin A, C, D, E, B₁, B₂, B₆, B₁₂, niacin, pantothenic acid, folic acid and biotin. Addition of vitamin K was however never observed. The most frequently added vitamins were found to be vitamin C (58% products), vitamin B₆ (46%) and B₁₂ (45%), whilst the least frequently added was biotin (16%). The highest amounts of vitamins A and D recorded were in fat spreads, whereas the highest levels of the B group vitamins, vitamin C and E were found in particular sweets (such as in fruit flavoured hard candy) at levels of 345 - 650% NRVs / 100g product, which complied with regulations. The manufacturer's portion sizes of the products were small, e.g. one fruit candy weighing 6 g. Despite the fact that vitamins are added to food products that are considered unhealthy due to their composition/contents (e.g. sweets and fruit drinks) the amounts of sweets on the market containing high amounts of vitamins has markedly risen within the last few years [17, 18, 19].

It was demonstrated that there were 56 fruit and/or vegetable juices that were fortified with vitamins available on the market. In addition, vitamins were added to non-alcoholic fruit and/or vegetable beverages that included nectars (15 products), drinks (78), syrups (19) and flavoured waters (5). Over 90% of them were enriched with vitamin C, where a 200 ml glass of juice or drink can supply 22-140% of its NRVs. The most frequent products were fruit/vegetable drinks (e.g. apple-peach-orange or banana-carrot-apple) but more rarely products based on just one type of fruit or vegetable (e.g. apple, orange, carrot). Over one fifth of such products were labelled by producers with the word 'multivitamins' incorporated into the product's name.

For the cereal products, breakfast flakes constituted 97 items, whilst two items were wheat flour, 3 were instant semolina and 9 were pasta products. The former were made from various raw materials such as sweetcorn, wheat, rice, oats, barley or rye and had various shapes (e.g. stars, circles, balls) and many were flavoured or had other foods added, e.g. chocolate, dried fruit and honey in 27, 18 and 7 products, respectively.

Sweets were also frequently fortified with vitamins; e.g. fruit pastilles, chewing sweets and sweetgums that constituted 57 items as well as 20 cereal bars and 16 cakes products. A somewhat smaller groups of fortified products were instant drinks and desserts which consisted of 16 cocoa products, 31 teas, 4 cappuccinos and 29 jellies. In powder forms, they contain 100-286% of NRVs, however they are consumed in small amounts; e.g. typically around 2 teaspoonfuls (approx 15 g) are used to make up a given glassful of drink.

Amongst the fortified dairy products were 21 homogenised cottage cheeses, 11 yoghurts, 12 flavoured milky drinks (e.g. with strawberry, vanilla, banana etc.) 3 plain milks and two dairy puddings. These products are most often fortified with fat soluble vitamins among them 75% contained added vitamin D at levels of 15-25% NRVs per 100 g of product.

The enriched products contained also some that were milk substitutes consisting of 18 soya drinks and 15 desserts, variously flavoured with for instance chocolate or vanilla together with 2 rice drinks and 2 oat drinks. Such products are in fact especially recommended for those on special diets like for vegans or people suffering from various food intolerances, e.g. lactose intolerance, where dairy products need to be avoided. They are enriched with vitamins D, B₂ and B₁₂.

Poland and other EU countries like the Netherlands, Belgium and the UK legally oblige manufacturers to enrich margarine products with vitamins A and D [22]. Maximum levels of vitamin A permitted in the finished product must not however exceed 900 µg and 7.5 µg for vitamin D [12]. These vitamin A and D fortified fat spreads, whenever identified in the products studied,

Table 1. Range, mean (x±SD), median (Me) of vitamins content in groups of fortified products available on the Warsaw market in 2012

{ food categories according to the classification system FoodEx } (n=588)	Vitamins content per 100 g or 100 ml											
	A (µg)	D (µg)	E (mg)	C (mg)	B ₁ (mg)	B ₂ (mg)	Pantothenic acid (µg)	B ₆ (mg)	Niacin (mg)	Folic acid (µg)	Biotin (µg)	B ₁₂ (µg)
Cereal products {1} (n=111)												
x ± SD	n=8	n=5	n=59	n=45	n=99	n=100	n=88	n=103	n=98	n=99	n=18	n=95
min. - max.	120	1.93±1.28	9.22±2.75	45.8±21.6	1.0±0.33	1.20±0.41	4.82±1.56	1.32±0.51	13.7±4.53	164±56.4	43.1±30.0	1.48±0.77
Me	120	1.25-4.20	1.9-12.0	9.0-100	0.17-2.30	0.21-2.70	0.9-8.90	0.21-3.30	2.4-30.1	30-334	22.5-120	0.15-2.50
Dairy products {8} (n=49)												
x ± SD	n=10	n=37	n=13	n=5	n=6	n=7		n=15	n=2	n=2	n=5	n=5
min. - max.	133±28.4	0.94±0.24	2.03±0.45	14.0±6.2	0.3	0.39±0.02	-	0.3±0.10	40.3±4.6	37.0±43.5	-	0.39±0.18
Me	120-200	0.74-1.25	1.50-2.50	9.0-24.0	0.3	0.35-0.40	-	0.21-0.4	40.3	40.3	-	0.16-0.67
Sweets {10} (n=93)												
x ± SD	n=6	n=3	n=42	n=58	n=39	n=30	n=48	n=58	n=60	n=41	n=18	n=52
min. - max.	457±272	1.9	13.5±10.4	128±110	1.25±1.40	1.93±2.1	7.44±6.60	1.81±1.60	17.8±16.6	236±215	80.1±64.7	2.21±1.9
Me	120-800	1.9	1.6-41.4	12-520	0.17-4.90	0.21-7.1	0.9-28.8	0.21-7.0	2.30-63.0	30-830	22.5-230	0.15-9.0
Fat spreads* {11} (n=45)												
x ± SD	n=45	n=45	n=25	-	n=6	n=5		n=9	n=8	n=8	n=8	n=8
min. - max.	768±168	6.33±1.82	13.7±5.23	-	1.27±0.52	1.24±0.5	-	2.84±1.73	305±171	90-500	-	1.73±0.87
Me	330-900	2-7.5	2.5-20	-	0.5-2.1	0.4-1.6	-	0.7-5.0	250	250	-	0.5-2.5
Fruit and vegetable juices {12} (n=56)												
x ± SD	n=15	n=3	n=25	n=53	n=12	n=10	n=15	n=14	n=14	n=14	n=14	n=14
min. - max.	147±77.5	0.75	2.52±1.33	19.1±9.0	0.21±0.11	0.22±0.02	1.06±0.54	0.26±0.13	2.9±1.49	35.7±18.7	10.0±5.97	0.43±0.25
Me	120-400	0.75	1.5-6.0	9.0-56.0	0.17-0.55	0.21-0.28	0.9-3.0	0.21-0.70	2.4-8.0	30-100	7.5-25.0	0.15-1.25
Non-alcoholic beverages {13} (n=117)												
x ± SD	n=31	n=7	n=38	n=105	n=28	n=27	n=30	n=49	n=35	n=41	n=28	n=47
min. - max.	149±51.0	0.84±0.23	1.85±0.46	27.5±22.7	0.20±0.04	0.39±0.30	0.95±0.16	0.33±0.24	2.9±0.64	33.5±9.6	13.8±8.57	0.38±0.24
Me	120-320	0.75-1.35	1.5-4.0	9.0-125	0.17-0.3	0.21-1.0	0.9-1.62	0.11-1.0	2.4-4.32	30-80	7.5-30	0.15-1.0
Milk products substitutes {20} (n=37)												
x ± SD	n=11	n=26	n=7	n=2	n=25	n=25		n=25				n=25
min. - max.	141±24.7	1.60±1.28	1.63±0.16	9.0	0.25±0.08	0.21-0.4	-	-	-	-	-	0.51±0.36
Me	120-169	0.75-4.10	1.50-1.80	9.0	0.21-0.4	0.21	-	-	-	-	-	0.15-1.20
Instant beverages and dessert {20} (n=80)												
x ± SD	n=10	n=5	n=24	n=75	n=23	n=22	n=22	n=24	n=24	n=23	n=19	n=21
min. - max.	224±220	2.05±2.0	7.55±5.0	51.8±46.0	0.91±1.0	1.0±1.0	3.6±2.0	1.20±1.0	12.6±7.0	133±80.0	41.5±26.0	1.30±1.0
Me	120-800	0.75-5.0	1.8-20.6	7.3-200	0.17-2.10	0.21-4.0	0.9-10.8	0.21-2.94	2.4-28.0	30-308	7.5-113	0.2-2.5
Number of products (% of total amount)	136 (23%)	131 (22%)	233 (40%)	343 (58%)	213 (36%)	226 (38%)	203 (35%)	272 (46%)	231 (39%)	228 (39%)	97 (16%)	267 (45%)

* Obligatory fortified with vitamin A and vitamin D

** High vitamins content per 100 g of product is due to small portion of the product (i.e. 6-15 g) advised on the label by the manufacturer

were found to be compliant with the binding legislation. Studies conducted on the Warsaw market in 2010 concerning low-fat spreads, identified 39 products that contained similar levels of vitamins to the presented study i.e. vitamin A at 300-900 μg and vitamin D at 2-7.5 μg per 100 g of product [13]. In addition, manufacturers had been found to voluntarily also add vitamin E and certain B group vitamins to some of their margarines in 2012; earlier study by *Rolf* et al. showed similar findings.

The market for foodstuffs enriched in vitamins and/or minerals has in recent years been greatly expanding in Poland. In 1995 there were only 28 foodstuff products fortified with vitamins and/or minerals on the market. During 1995-2001 there were around 560 such products officially allowed onto the market, in which juices and non-alcoholic beverages comprised 43 and cereal products 17% [21]; numbers in fact similar to those presented.

In order to decrease neural tube defects in infants, almost 50 countries worldwide (e.g. Australia, Argentina, Canada, Chile, Costa Rica and the USA) have legislation for obligatory fortification of certain defined products in folic acid [4]. Such products most frequently include flour and those made of wheat; for e.g. flour in the USA contains 140 $\mu\text{g}/100$ g flour whilst in Canada and Chile these are respectively 150 μg and 220 μg [15]. In Poland, the question of whether to obligatory implement the fortifying of flour and wheat product was debated in 2006, where a team of the country's foremost experts were assembled by the Polish Ministry of Health to perform a risk benefit analysis [9]. Its conclusions stated that there are indeed health benefits to be gained by adding folic acid to foodstuffs but this should be on a voluntary basis so as not to compromise the right for consumer's freedom of choice (unpublished data). The market for foodstuffs enriched with folic acid is now developing dynamically. In 2009, shops in Warsaw had 166 such products available [18], whilst in 2011 there were 204 [19] and currently 230. When compared to the state of the Warsaw market in 2011, the most significant increase in the number of products enriched in folic acid were for sweets, cereal products and instant drinks. In 2012 the largest amounts of this vitamin were found in certain sweets and margarines; up to 500-800 $\mu\text{g}/100$ g, similarly as in 2011 [19].

Other product group that has also increased in the number of are those enriched with vitamin B₁₂, where 220 types were sold in 2011 rising to 267 in 2012, [17]; in particular this included cereal products and sweets. In 2011 the largest levels of vitamin B₁₂ were found in certain sweets, (4.5 $\mu\text{g}/100$ g) [17] that doubled in the following year.

In other countries, food producers enrich their products with vitamins and/or minerals depending on customer needs and their levels of acceptance. The

German market had 288 fortified foodstuffs already in 1994 of which 95 were beverages, 57 sweets, 53 cereals, 35 dairy, 31 powdered instant beverages and 17 ready-to-eat meals. It was found that these products were enriched with 10 vitamins (E, B₁, B₂, B₆, B₁₂, C, niacin, folic acid, biotin and pantothenic acid) and 7 minerals. The numbers of nutrients added varied between one (in 94 products) to 16 (in 3 products). Also, in a considerable number of cases, amounts for fortification of more than 100% (maximum 660%) of the NRVs have been observed [5]. A UK study from 1999, showed 262 fortified products on the market consisting of 44% breakfast cereal, 9.5% soft drinks with the rest being milk, soya drinks, biscuits, bread and yoghurts. Nearly 75% of products contained high levels of fat, sugar and salt, suggesting that the fortification was really a marketing tool for promoting such foodstuffs, which do not necessarily bring about health benefits [1]. In such cases, nutritional profiles could be useful to manufacturers for suitably enriching their products; health claims so arising, are dealt with by the European Parliament [7].

The Austrian market was found to have 470 fortified foodstuffs products in 2005 that included beverages, sweets, cereals, dairy, fats, salt and foods for infants/small children. Iodated salt was the only example of this being mandatory whilst the remainder were voluntary. The most frequently added nutrients were vitamin C (73%), B₆ (43%) and niacin, (37%) [23].

The universal availability of fortified foodstuffs and dietary supplements provides the opportunity to combat nutrient deficiencies, but can also pose a health risk if intakes become excessive. The voluntary enrichment of foodstuff products with nutrients is also a good marketing strategy for manufacturers. Nevertheless, appropriate and effective nutritional education is the best means for consumers to make informed choices when shopping for food.

CONCLUSIONS

1. In 2012 there were 588 foodstuff products on the Warsaw market fortified with vitamins. The developing market for fortified foodstuffs has created the need for appropriate consumer education as to their role in healthy nutrition. The consumer should himself make informed choices when buying fortified foodstuffs. Whenever dietary intakes are assessed, (whether amongst individuals or population groups), fortified products should also be accounted for.
2. Even though the promotion of high sugar and fat products (e.g. sweets and fruit drinks) seems controversial, a large number of these are fortified with vitamins through which their marketing is targeted at children and adolescents.

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Conflict of interest

The authors declare no conflict of interest

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